

REMARKS

Applicants' invention relates to a process for the production of a cellular composite. This process comprises: (A) preparing a mixture of (1) a polyisocyanate and (2) water, (B) adding the mixture formed in (A) to (3) hollow inorganic microspheres under low shear mixing, (C) completely filling a mold with the mixture formed in (B), and (D) heating the filled mold at a temperature of from 100 to 280°C. This reacts the polyisocyanate and water to form a polyurea which binds the hollow microspheres, and forms a cellular composite. These cellular composites have a high compressive strength and a low density at typical (i.e. conventional) binder concentrations (see page 1, lines 27-31 of the present application).

Rejection under 35 U.S.C. 103(a)

Claims 1-9 were rejected under 35 U.S.C. 103(a) as being unpatentable over the Cioca et al reference (U.S. Patent 4,380,474) in view of the Markusch et al reference (U.S. Patent 3,965,051).

The Cioca et al reference is directed to polyisocyanate reaction products. More specifically, it relates to reaction products of polyisocyanates and tanned leather scrap. The resultant products have comparable integrity, workability and economic advantage as, for example, chip board or particle board. Tanned leather scrap refers to by-products of leather production and includes the shavings and trimmings of a tanned leather resulting from the manufacture a leather product.

Composite materials are disclosed by the Markusch et al reference. These composite materials comprise inorganic or organic particles or fibers bonded together with an organic polyisocyanate which contains ionic groups. The resultant composite materials are suitable for filling cracks, joints, etc., as well as for making panels and other products for the building industry.

Applicants respectfully submit that one of ordinary skill in the art would not combine these references in the manner necessary to arrive at the presently claimed invention.

The process disclosed in the Cioca et al reference comprises reacting a polyisocyanate and tanned leather scrap. Tanned leather scrap includes by-products

of leather production such as, for example, shavings and trimmings of leather produced in the manufacture of leather goods (column 2, lines 11-14). The dimensions of leather scrap vary and may be anything from powdery particulates to thin small flexible sheets. It also includes chrome shavings. These chrome shavings normally contain a large amount of water, i.e. up to 50%. Water is known to react with isocyanates to form ureas. Thus, it may be desirable to dry the tanned leather scrap to a predetermined water/moisture content to provide a consistent product. It is preferable to dry the tanned leather scrap to the equilibrium state in which the water content is 6 to 12% by wt. See column 2, lines 15-36 of the '474 patent.

These chrome shavings are mixed with polyisocyanate to form the final product. Typically, the tanned leather scrap is from 50 to 99% by wt., more preferably from 80 to 99% by wt., based on the total weight of the article, and the polyisocyanate is from 1 to 50% by wt., more preferably from 1 to 20% by wt., based on the total weight of the article. After mixing the scrap leather with the polyisocyanate to form a mixture which is as homogeneous as possible, the mixed materials are placed in a press and heated to cure. Sufficient pressure is applied to expel air from the mixture and sufficient heat is applied to react the isocyanate with the tanned leather scrap. See column 3, lines 41-48; column 3, line 62 through column 4, line 18.

Applicants respectfully submit that the Cioca et al reference does not clearly disclose that the polyisocyanate component therein should be pre-mixed with water to form a mixture, and this mixture added to the tanned leather shavings. A mixture of polyisocyanate and water is, however, clearly required by the present invention. Two of the three examples in this reference disclose mixing the chrome shavings with PMDI or a 50:50 solution of PMDI:4,4'-MDI. Only the last example provides any indication that the isocyanate can be or is emulsified in water before mixing with the chrome shavings. The purpose of this was to make the isocyanate sprayable. See column 4, lines 65-66. This reference does not provide any clear guidance, however, that polyureas are suitable binders. Rather, it specifically discloses that the polyisocyanate acts as a binder for the chrome shavings (column 3, lines 1-2).

The Markusch et al reference discloses numerous types of particles and/or fibers, including inorganic and organic particles and/or fibers. These include, but are not limited to, solid inorganic and organic substances which may be present in the form of powder, granules, wire, fibers, dumbbell shaped particles, crystallites, spirals, rods, solid beads, hollow beads, plastic foam particles, non-woven webs, woven and knitted fabrics, tapes, pieces of foil, dolomite, chalk, asbestos, sand, talcum, alkali metal silicates, zeolites, mixed silicates, cements, glass fibers, carbon fibers, expanded clay particles, hollow glass beads, glass powder, lava and pumice particles, etc. (see column 9, lines 19-68 for a thorough list).

The Markusch et al reference requires an organic polyisocyanate containing ionic groups to act as the bonding agent for the various particles or fibers therein as described at column 2, lines 49-54. As discussed at column 1, lines 24-44 of the '051 patent, there are frequent difficulties when attempting to add or bond a polyisocyanate that is not modified with ionic groups with specific types of particular or fibrous materials. Thus, the solution proposed by Markusch et al to these difficulties is the inclusion of ionic groups in the organic polyisocyanate component!

Applicants therefore submit that one of ordinary skill in the art would **not** be motivated to substitute any of the numerous types of particles and/or fibers including the inorganic hollow particles as disclosed in the Markusch et al reference into the process of the Cioca et al reference since the Cioca et al reference only uses conventional polyisocyanates, i.e. those polyisocyanates which are not modified with ionic groups. In fact, one of ordinary skill in the art would not expect most of these types of particles and/or fibers to be suitable for the process of the Cioca et al reference in view of the problems associated with such combinations as described by the Markusch et al reference.

It is broadly disclosed in the Markusch et al reference that hollow beads, hollow glass beads and hollow metal silicate beads are suitable particulate and fibrous materials (column 9, lines 23, 33 and 56-57). Only on hindsight does it become "obvious" to select these "hollow" materials from the numerous other materials disclosed by the Markusch et al reference as suitable particles for bonding with a mixture of a polyisocyanate and water as required by the presently claimed

invention. Such a perspective does not, however, provide a proper basis for rejecting the presently claimed invention as being *prima facie* obvious over the Cioca et al reference in view of the Markusch et al reference.

In the Cioca et al reference, it is only broadly disclosed that the composites formed therein exhibit similar characteristics as chipboard and are rigid. No specific properties are, however, disclosed for these composites.

In the examples of the Markusch et al reference, gross densities and compression strengths are provided. In Example 1 which used cement, sand, water and an ionically modified polyisocyanate, the gross density was 1.97 g/cm³ (i.e. about 123 lb/ft³) and the compression strength was 142 kp/cm² (i.e. about 2019 psi). By comparison, Example 3 of the present application clearly demonstrates that at densities of about 36.8 lb/ft³, a compression strength of 2090 psi can be attained! In other words, the present invention allows the production of composite materials which have considerably lower densities than those of the Markusch et al reference, but has essentially the same or similar compression strengths.


For Examples 2-50 of the Markusch et al reference, the highest density was 2.14 g/cm³ in Example 9. This corresponds to about 133.60 lb/ft³. The compression strength of Example 9 was about 7067 psi. Example 24 had the lowest density at 1.74 g/cm³, or 108.63 lb/ft³. The compression strength of Example 24 was about 1407 psi. This compression strength was lower than that of Examples 2, 3 and 4 of the present application. However, the densities of Examples 2, 3 and 4 in the present application were 34.4, 26.8 and 39.9 lb/ft³, respectively.

The lowest compression strength reported by the Markusch et al reference was 10 kp/cm² (Example 28) and the highest was 592 kp/cm² (Example 17). These values correspond to about 142 psi and about 8418 psi, respectively. However, the densities of these materials are roughly 118.62 and 123.61 lb/ft³, respectively. Obviously, these compression strengths overlap with those of the examples in the present application but the densities of these materials in the Markusch et al reference are at least about 3 times that of the presently claimed composites. This is simply not obvious to the skilled artisan upon reading the disclosure of the Cioca et al reference and the Markusch et al reference.

Applicants respectfully submit that one of ordinary skill in the art would not expect that the presently claimed combination of a polyisocyanate and water mixture being added to inorganic hollow microspheres under low shear mixing, and molding under the presently claimed temperature requirements would result in composites having low densities and high compression strengths! This is simply not suggested by the Cioca et al reference or the Markusch et al reference. Only **after** reading Applicants' specification does this become obvious to the skilled artisan. Such a perspective does **not**, however, provide a proper basis for rejecting the presently claimed invention as being *prima facie* obvious over this combination of references!

It is respectfully submitted that this rejection is in error and requested that it be withdrawn. In view of the preceding remarks, allowance of Claims 1-9 is respectfully requested.

Respectfully submitted,

By 
N. Denise Brown
Agent for Applicants
Reg. No. 36,097

Bayer Polymers LLC
100 Bayer Road
Pittsburgh, Pennsylvania 15205-9741
(412) 777-3804
FACSIMILE PHONE NUMBER:
(412) 777-3902

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